

CLAIMS

What is claimed is:

1. A method of forming a compliant marking tool for use with a machine tool to place marks on various portions of a workpiece being operated on by the machine tool, comprising:

providing a marking tool having a tip portion for marking on the workpiece;

mounting the marking tool in a holder with the tip portion facing the workpiece;

supporting the holder from a flexible element able to flex in two dimensions, the flexible element being supported from a portion of the machine tool; and

using the machine tool to move the flexible element such that the tip portion of the marking tool contacts the workpiece and marks on the workpiece, the flexible element enabling the marking tool to follow a contour of the workpiece.

2. The method of claim 1, further comprising pivotally supporting the holder relative to the flexible element.

3. The method of claim 1, further comprising mounting the marking element in the holder to facilitate sliding longitudinal movement of the marking tool relative to the holder.

4. The method of claim 3, further comprising coupling a biasing element between the holder and the marking tool to provide a biasing force to assist in maintaining the marking tool in contact with said contour of said workpiece as said marking tool is moved over said workpiece.

5. The method of claim 2, further comprising pivotally supporting the holder via a pivot pin supported from a bracket member, the pivot pin enabling the holder to move pivotally relative to the flexible element.

6. The method of claim 1, further comprising forming the flexible element as a rectangular beam from material that enables bending and twisting of said flexible element.

7. The method of claim 5, further comprising using a biasing member in contact with said pivot pin to provide a biasing force that tends to assist the marking tool in following said contour of said workpiece as said marking tool is moved relative to said workpiece.

8. A method of forming a compliant marking tool for use with a machine tool to place marks on various portions of a workpiece being operated on by the machine tool, comprising:

providing a marking tool having a tip portion for marking on the workpiece;

mounting the marking tool in a holder with the tip portion facing the workpiece;

mounting the holder in a member to enable pivotal movement of the holder;

supporting the member from a flexible element able to flex in two dimensions, the flexible element being supported from a portion of the machine tool; and

using the machine tool to move the flexible element such that the tip portion of the marking tool contacts the workpiece and marks on the workpiece, the flexible element and the member enabling the marking tool to follow a contour of the workpiece.

9. The method of claim 8, further comprising mounting the marking element in the holder to facilitate sliding longitudinal movement of the marking tool relative to the holder.

10. The method of claim 8, further comprising coupling a biasing element between the holder and the marking tool to provide a biasing force to assist in maintaining the marking tool in contact with said contour of said workpiece as said marking tool is moved over said workpiece.

11. The method of claim 8, further comprising using a biasing element to bias said holder about an axis extending orthogonal to said marking tool, to further enable said marking tool to follow said contour of said workpiece.

12. The method of claim 8, wherein supporting the member from a flexible element comprises supporting the member from a rectangular element able to bend and twist in response to forces experienced by said marking tool when said marking tool moves over said contour of said workpiece.

13. A method of marking on a workpiece being acted on by a machine tool, the method comprising:

supporting a marking tool having a tip portion adapted to contact a surface of the workpiece, from a movable portion of the machine tool;

supporting the marking tool from a flexible component enabling the marking tool to move in two orthogonal planes in response to contact with said workpiece to enable the marking tool to follow a contour of said workpiece as said marking tool is moved relative to the workpiece;

further securing the marking tool to the machine tool such that the marking tool is in a known position relative to a machine axis of the workpiece; and

using a computer program to control the machine tool to move the marking tool to place marks on the workpiece at precise locations on the workpiece.

14. The method of claim 13, wherein supporting the marking tool from a flexible element comprises supporting the tool from a flexible beam.

15. The method of claim 13, wherein supporting the marking tool comprises supporting the marking tool for pivotal movement.

16. A method of marking on a workpiece being acted on by a machine tool, the method comprising:

supporting a marking tool having a tip portion adapted to contact a surface of the workpiece, from a movable portion of the machine tool;

supporting the marking tool from a flexible component enabling the marking tool to move in two orthogonal planes in response to contact of said tip portion with said workpiece to enable the tip portion to follow a contour of said workpiece as said marking tool is moved relative to the workpiece;

aligning the marking tool relative to a laser associated with the machine tool such that the location of the marking tool is determined relative to a laser beam of the laser, wherein the laser beam is directed at the workpiece; and

using a computer program to control movement of the marker by the machine tool in accordance with said laser beam generated by said laser, to cause said tip portion to mark on said workpiece at predetermined locations.

17. The method of claim 16, wherein supporting the marking tool from a flexible component comprises supporting the marking tool from a beam-like element that is able to bend and twist.

18. The method of claim 16, wherein supporting the marking tool from a flexible component comprises supporting the marking tool from for sliding linear movement relative to said flexible component.

19. The method of claim 16, wherein supporting the marking tool from a flexible component further comprises supporting the marking tool for pivotal movement relative to the flexible component.

20. A method of using an NC controlled fiber placement machine to mark detail locations on a work piece by using a marking tool attached to the fiber placement machine, the method comprising the steps of:

providing an NC controlled fiber placement machine with a work piece positioned on the fiber placement machine;

providing a marking tool having a flexible member that is configured and adapted to flex in response to the marking tool contacting the work piece, a holder pivotably connected to the flexible member so that the holder can pivot relative to the flexible member, and a marking member attached to the holder so that a tip of the marking member can contact the work piece and make a mark on the work piece;

attaching the marking tool to the fiber placement machine so that the marking member is in a known position relative to a machine axis of the fiber placement machine;

providing an NC program to control the fiber placement machine so that when the NC program is run the tip of the marking member contacts the work piece and makes marks on the work piece at predetermined locations; and

running the NC program so that the tip of the marking member makes marks on the work piece at the predetermined locations.

21. The method of claim 20, wherein:

the step of providing an NC program comprises modifying an existing NC program that controls the operation of the fiber placement machine to account for the known location of the tip of the marking member and locations of boundaries to be marked so that the modified NC program can be used to control the marking tool on the fiber placement machine to make marks on the work piece at the determined locations; and

the step of running the NC program comprises running the modified NC program.

22. The method of claim 20, wherein:

the step of attaching the marking tool further comprises attaching the marking tool on the fiber placement machine so that the tip of the marking member is aligned with and offset a known distance from a laser on the fiber placement machine;

the step of providing an NC program further comprises the step of modifying an NC program written to control the laser by replacing an offset of the laser in the NC program written to control the laser with a new offset based upon the known offset between the tip of the marking member and the laser so that the modified NC program can be used to control the marking tool on the fiber placement machine to make marks on the work piece at the predetermined locations; and

the step of running the NC program further comprises running the modified NC program.